REMARKS

Examiner rejected claims 1-7 under 35 U.S.C. 103(a). In particular, the Examiner stated:

> Claims 1-7, are rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee et al. (US 5,808,735) in view of Mishima et al. (US 4,823,194).
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> Regarding claims 6 and 7, Lee discloses a system for characterizing defects on semiconductor wafers comprising: an image acquisition unit being operable to acquire a first image and an associated second image (column 4, lines 44-57), the first and second images having a plurality of pixels (column 6, lines 21-25) with each pixel being defined by a location coordinate (column 5, lines 32-37) and gray level (column 2, lines 25-34).
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> Lee discloses memory for storing the image data (column 6, lines 45-50) without any specific details regarding plurality of memory locations and a processor to plot gray levels of pixels.
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> In the same field of endeavor, however, Mishima discloses a system for processing gray scale images comprising a plurality of memory locations storing the first and second image data (column 7, lines 34-44 and figure 5, element 54); a processor being operable to plot the gray levels of pixels corresponding to each image (column 5, lines 22-35 and figures 2a-2d).
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> Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the plurality of memory locations and a processor to plot gray levels as taught by Mishima in the system of Lee because Mishima provides Lee with a gray level image processing system which can process gray scale images clearly at a high speed even if the original image has a complicated background. Additionally, the use of plurality of memory locations to store images and plotting gray levels of image pixels are routinely performed.
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> As to claims 1-5, the steps claimed as method is nothing more than restating the function of the specific components of the apparatus (including aligning the first image with a second image, video monitor and plotting a threshold window; see Lee, figure 2A, step 210, figure 1, element 60; and Mishima figure 6) as claimed above and therefore, it would have been obvious, considering the aforementioned rejection for the apparatus claims 6-7 above.

Applicant respectfully traverses the Examiner's rejection.

Regarding claims 6 and 7:

Lee et al.: The Examiner has asserted that: (a) Lee et al. (at col. 4, lines 44-57) discloses acquiring a first image and an associated second image; (b) Lee et al. (at col. 6, lines 21-25) discloses that the first and second images have a plurality of pixels; and (c) Lee et al. (at col. 5, lines 32-37 and at col. 2, lines 25-34) discloses that each pixel may be defined by a location coordinate and gray level. Applicant agrees with these assertions.

Lastly, the Examiner has also asserted that Lee et al. (at col. 6, lines 45-50) teaches a memory for storing image data. However, Applicant disagrees with this assertion. In particular, Applicant disagrees because, at col. 6, lines 45-50, Lee et al. states: "The x-y locations of corresponding pixels having intensity values $P_T(I_{max})$ and $P_R(I_{max})$ that differ by an amount exceeding the intensity-error threshold I_{TH} are stored in memory as an array of potential defect pixels (the defect array D)."

In light of the above, Applicant respectfully submits that **Lee et al.** teaches a system that **is completely different from**: (a) the computer readable medium of claim 6 which requires an array comprising a plurality of memory locations storing data representing a **plot** of gray levels of pixels from a first image **against** gray levels of corresponding pixels from a second image; and (b) the defect inspection system of claim 7 which requires a processor being operable to plot gray levels of pixels from a first image **against** gray levels of corresponding pixels from a second image.

In particular, as set forth at col. 5, lines 54-67, Lee et al. teaches that defects are detected by aligning test and reference images and then **subtracting** the images one from the other. Intensity differences between corresponding test and reference pixels that exceed an intensity-error threshold indicate the presence of a defect. Specifically, as set forth at col. 6, lines 21-30, Lee et al. discloses:

> The test and reference images are aligned and their relative intensities are compared pixel-by-pixel. The x-y locations of any test and reference pixel pair P_T, P_R having intensity values I_{MAX} that differ by an amount exceeding the intensity-error threshold I_{TH} assigned to the x-y locations are identified as potential defect pixels. The **intensity differences** of the remaining pixels are then used to create an intensity histogram. The peak value of the intensity histogram represents the most common intensity difference between test and reference pixel pairs P_T, P_R. (Emphasis added)

Specifically, as set forth at col. 6, lines 41-56, Lee et al. discloses:

> Once the test and reference images are aligned in three dimensions and normalized for intensity, the intensity values I_{max} of corresponding test and reference images are compared pixel-by-pixel (step 235) pixels using the intensity-error threshold I_{TH} assigned to the z level associated with the reference pixel. The x-y locations of corresponding pixels having intensity values $P_T(I_{max})$ and $P_R(I_{max})$ that differ by an amount exceeding the intensity-error threshold I_{TH} are stored in memory as an array of potential defect pixels (the defect array D). In one embodiment, the defect array D is represented in memory using a single binary bit for each pixel: a logic one or a logic zero respectively represents the presence or absence of a defect at a given x-y location. Alternatively, a defect array may be represented in memory using multiple bits to store the intensity and/or Z difference associated with each defect pixel.

As the Examiner can readily appreciate from this, Lee et al. provides no teaching, disclosure or suggestion of any kind for plotting a gray level of a pixel from the first image **against** a gray level of a corresponding pixel from the second image. As such, Applicant respectfully submits that Lee et al. does not disclose, teach, hint or suggest, in any manner whatsoever, making the unique plot of claims 6 or 7 because the difference identification taught by Lee et al. is completely different from the unique plot.

Mishima et al.: The Examiner has asserted that Mishima et al. (at col. 7, lines 34-44 and figure 5, element 54) discloses a system for processing gray scale images comprising a plurality of memory locations storing the first and second image data. Applicant agrees. However, Mishima et al. at col. 7, lines 34-44 states: "The processor 51 further has a local maximum filter 58, which read out the image data from the image memory 54 and execute the filtering operation as already described, and again the result thereof is stored in the image memory 54. There is provided in the processor 51 an image calculator 60 which carries out the subtraction between various image data stored in the image memory 51. Also the result of the calculation is stored in the image memory 54 again." As the Examiner can readily appreciate from this, Mishima et al. discloses nothing relating a plot of gray levels of corresponding pixels in each image.

In addition, the Examiner has asserted that Mishima et al. (at col. 5, lines 22-35 and figures 2a-2d) teaches a processor being operable to plot the gray levels of pixels corresponding to each image. Applicant disagrees with this assertion. In particular, although Mishima et al. discloses at col. 5, lines 22-35 a processor being capable of plotting "a gray level distribution profile," **Mishima et al. does not teach**, in any manner whatsoever: (a) an array for storing data representing a plot of gray level of pixels from a first image **against** gray levels of corresponding pixels from a second image as required by claim 6; or (b) a processor being operable to plot gray levels of pixel from a first image **against** gray levels of corresponding pixels from a second image as required by claim 7.

Combination of Lee et al. and Mishima et al.: Applicant respectfully submits that there is no reason, suggestion, or motivation in Lee et al. or Mishima et al., or anywhere else, that would have led one of ordinary skill in the art to combine Lee et al. and Mishima et al to provide the inventions of claims 6 or 7. In particular, as is set for the above, neither Lee et al. nor Mishima et al. teach, hint or suggest plotting gray levels of pixel from a first image **against** gray levels of corresponding pixels from a second image. In addition, Applicant respectfully submits that even if a person of ordinary skill in the art were to combine Lee et al. and Mishima et al., that person would not arrive at the invention of claims 6 or 7. Applicant respectfully submits that this would be the case because there would be no plotting gray levels of pixels from a first image **against** gray levels of corresponding pixels from the second image . As such, Applicant respectfully submits that claims 6 and 7 are patentable over Lee et al. in view of Mishima et al.

Regarding claims 1-5: Applicant respectfully submits that claims 1-5 are patentable over Lee et al. in view of Mishima et al. for the reasons set forth above. In particular, claims 1-5 require plotting gray levels of pixels from a first image against gray levels of corresponding pixels from a second image for aligned pixel locations. As set forth above, neither Lee et al. nor Mishima et al., whether taken alone or in combination, provide any teaching, hint, or suggestion of any kind, for plotting gray levels of pixels from a first image against gray levels of corresponding pixels from a second image. As such, Applicant respectfully submits that claims 1-5 are patentable over Lee et al. in view of Mishima et al.

In addition, Applicant respectfully submits that neither Lee et al. nor Mishima et al., whether taken alone or in combination, provide any teaching, hint, or suggestion of any kind, for plotting a threshold window on a plot of gray levels of pixels from a first image **against** gray levels of corresponding pixels from a second image as required by claim 2. In particular, Applicant respectfully submits that Lee does not teach plotting a threshold. Applicant respectfully submits that col. 10, line 29 to col. 11, line 2 of Lee et al. discloses a process of establishing multiple error thresholds I_{TH} but does not teach, disclose or suggest in any manner plotting a threshold as required by claim 2.

In addition, Applicant respectfully submits that neither Lee et al. nor Mishima et al., whether taken alone or in combination, provide any teaching, hint, or suggestion of any kind, for storing the plot as required by claim 3.

In light of the above, Applicant respectfully requests that the Examiner withdraw this rejection.

Examiner stated:

> The prior art made of record and not relied upon is consider pertinent to applicant's disclosure.
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> Ravid et al. (US 6,256,093) discloses an automatic defect classification system (figure 4).
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> Morrison et al. (US 5,033,096) discloses a system for determining position of a given feature of an article (figure 5).
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> Michael (US 5,943,441) discloses an edge contour tracking system.
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> Yair et al. (US Patent 6,512,849) discloses a system for finding objects in an image (figure 7).
>
> Baker et al. (US 5,291,535) discloses a system for detecting solder defects on printed circuit boards.

Applicant has reviewed the above-cited references and has found them to be no more pertinent that the references discussed above in response to the rejection of claims 1-7.

In light of the above, Applicant respectfully submits that all the remaining claims are allowable, and Applicant respectfully requests that the Examiner reconsider the case and pass the case to issue. Should the Examiner have any questions or wish to discuss any aspect of the application, a telephone call to the undersigned would be welcome.

Respectfully submitted,

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